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Soot particles emitted by aircraft engines in the troposphere and low stratosphere have an impact on the global radiative forcing by promoting the formation of condensation trails (contrails) that may evolve in artificial cirrus clouds [Schumann, 2013]. These particles have also an impact on the air quality [Lee, 2010] and their sub-micrometer size is now a matter of questions regarding their effect on human health [Ferry, 2011].

We present here an experimental characterization of the morphology, structure and chemical properties of soot particles emitted from various aircraft engines (CFM56-5C, -7B, SaM-146), and a combustor [Delhaye, 2008 ; Petzold, 2011]. Soot particles have been collected by direct impaction on electron microscope grids. Transmission electron microscopy (TEM) is used to determine the aggregates fractal dimension as well as soot primary particles and aggregates size distributions. The morphology, structure and texture of primary particles are also determined in addition to the elemental composition by the mean of X-ray energy dispersive spectrometry (XREDS).

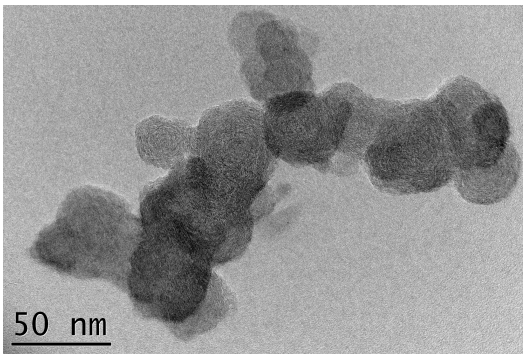

Figure 1: soot aggregate emitted from a SaM146 engine

Whatever the aircraft engine considered, we find that soot aggregates exhibit a fractal morphology (cf. Fig.1) and are composed of primary particles with diameter values distributed between 5 to 60 nm following a lognormal law (cf. Fig. 2). These particles show a turbostratic texture and are mainly composed of C, O and traces of S. Carbon cristallites that compose of soot particles have in-plane extensions of ~ 0.2 nm and interplanar distances larger or equal to ~ 0.36 nm. We will present and compare detailed microphysical characteristics of soot aggregates emitted by the set of turbofan engines and the considered combustor.

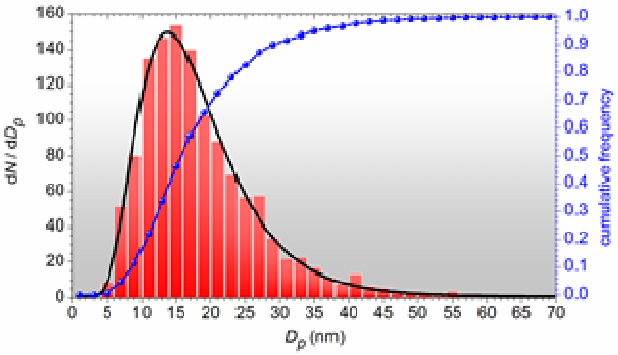

Figure 2 : size distribution of primary particles emitted from a SaM146 engine

Acknowledgements

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